

EXHIBIT 43


BloombergBusinessweek


Uber's First Self-Driving Fleet Arrives in Pittsburgh This Month

The autonomous cars, launching this summer, are custom Volvo XC90s, supervised by humans in the driver's seat.



Uber's modified Volvo XC90 sport-utility vehicle.

Source: Uber

by **Max Chafkin**

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Near the end of 2014, Uber co-founder and Chief Executive Officer Travis Kalanick flew to Pittsburgh on a mission: to hire dozens of the world's experts in autonomous vehicles. The city is home to Carnegie Mellon University's robotics department, which has produced many of the biggest names in the newly hot field. Sebastian Thrun, the creator of Google's self-driving car project, spent seven years researching autonomous robots at CMU, and the project's former director, Chris Urmson, was a CMU grad student.

"Travis had an idea that he wanted to do self-driving," says John Bares, who had run CMU's National Robotics Engineering Center for 13 years before founding Carnegie Robotics, a Pittsburgh-based company that makes components for self-driving industrial robots used in mining, farming, and the military. "I turned him down three times. But the case was pretty compelling." Bares joined Uber in

January 2015 and by early 2016 had recruited hundreds of engineers, robotics experts, and even a few car mechanics to join the venture. The goal: to replace Uber's more than 1 million human drivers with robot drivers—as quickly as possible.

The plan seemed audacious, even reckless. And according to most analysts, true self-driving cars are years or decades away. Kalanick begs to differ. “We are going commercial,” he says in an interview with *Bloomberg Businessweek*. “This can’t just be about science.”



Travis Kalanick, CEO of Uber

Photograph: Britta Pedersen/Picture-Alliance/DPA via AP

Starting later this month, Uber will allow customers in downtown Pittsburgh to summon self-driving cars from their phones, crossing an important milestone that no automotive or technology company has yet achieved. Google, widely regarded as the leader in the field, has been testing its fleet for several years, and Tesla Motors offers Autopilot, essentially a souped-up cruise control that drives the car on the highway. Earlier this week, Ford announced plans for an autonomous ride-sharing service. But none of these companies has yet brought a self-driving car-sharing service to market.

Uber's Pittsburgh fleet, which will be supervised by humans in the driver's seat for the time being, consists of specially modified Volvo XC90 sport-utility vehicles outfitted with dozens of sensors that use cameras, lasers, radar, and GPS receivers. Volvo Cars has so far delivered a handful of vehicles out of a total of 100 due by the end of the year. The two companies signed a pact earlier this year to spend \$300 million to develop a fully autonomous car that will be ready for the road by 2021.

The Volvo deal isn't exclusive; Uber plans to partner with other automakers as it races to recruit more engineers. In July the company reached an agreement to buy Otto, a 91-employee driverless truck startup that was founded earlier this year and includes engineers from a number of high-profile tech companies attempting to bring driverless cars to market, including Google, Apple, and Tesla. Uber declined to disclose the terms of the arrangement, but a person familiar with the deal says that if targets are met, it would

be worth 1 percent of Uber's most recent valuation. That would imply a price of about \$680 million. Otto's current employees will also collectively receive 20 percent of any profits Uber earns from building an autonomous trucking business.

Otto has developed a kit that allows big-rig trucks to steer themselves on highways, in theory freeing up the driver to nap in the back of the cabin. The system is being tested on highways around San Francisco. Aspects of the technology will be incorporated into Uber's robot livery cabs and will be used to start an Uber-like service for long-haul trucking in the U.S., building on the intracity delivery services, like Uber Eats, that the company already offers.

The Otto deal is a coup for Uber in its simmering battle with Google, which has been plotting its own ride-sharing service using self-driving cars. Otto's founders were key members of Google's operation who decamped in January, because, according to Otto co-founder Anthony Levandowski, "We were really excited about building something that could be launched early."



Volvo is expected to deliver a total of 100 specially modified SUVs to Uber by the end of the year.

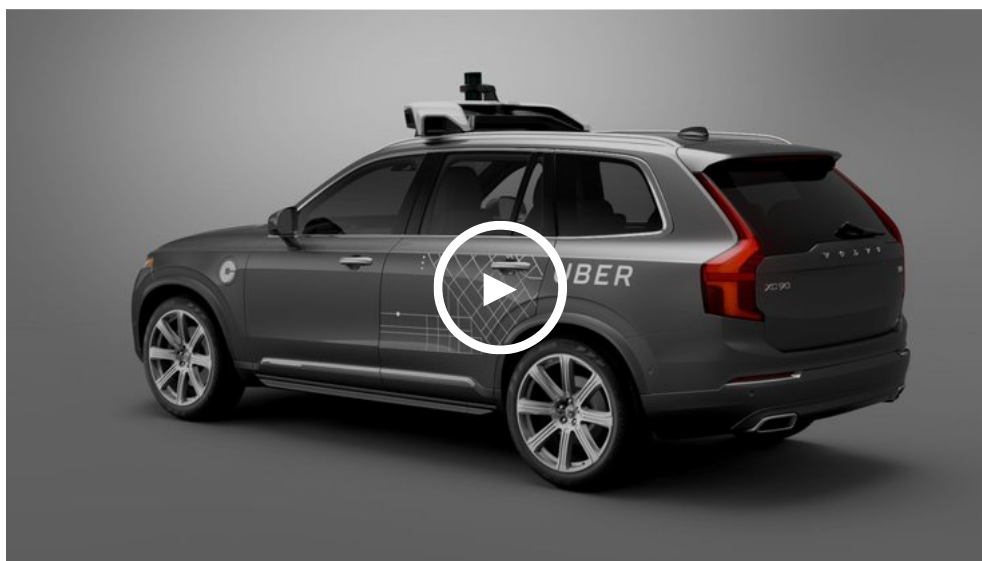
Source: Courtesy Uber

Levandowski, one of the original engineers on the self-driving team at Google, started Otto with Lior Ron, who served as the head of product for Google Maps for five years; Claire Delaunay, a Google robotics lead; and Don Burnette, another veteran Google engineer. Google suffered another departure earlier this month when Urmson announced that he, too, was leaving.

"The minute it was clear to us that our friends in Mountain View were going to be getting in the ride-sharing space, we needed to make sure there is an alternative [self-driving car]," says Kalanick. "Because if there is not, we're not going to have any business." Developing an autonomous vehicle, he adds, "is basically existential for us." (Google also invests in Uber through Alphabet's venture capital division, GV.)

Unlike Google and Tesla, Uber has no intention of manufacturing its own cars, Kalanick says. Instead, the company will strike deals with auto manufacturers, starting with Volvo Cars, and will develop kits for other models. The Otto deal will help; the company makes its own laser detection, or lidar, system, used in many self-driving cars. Kalanick believes that Uber can use the data collected from its app, where human drivers and riders are logging roughly 100 million miles per day, to quickly improve its self-driving mapping and navigation systems. "Nobody has set up software that can reliably drive a car safely without a human," Kalanick says. "We are focusing on that."

In Pittsburgh, customers will request cars the normal way, via Uber's app, and will be paired with a driverless car at random. Trips will be free for the time being, rather than the standard local rate of \$1.05 per mile. In the long run, Kalanick says, prices will fall so low that the per-mile cost of travel, even for long trips in rural areas, will be cheaper in a driverless Uber than in a private car. "That could be seen as a threat," says Volvo Cars CEO Hakan Samuelsson. "We see it as an opportunity."



Uber to Launch Self-Driving Cars in Pittsburgh This Month

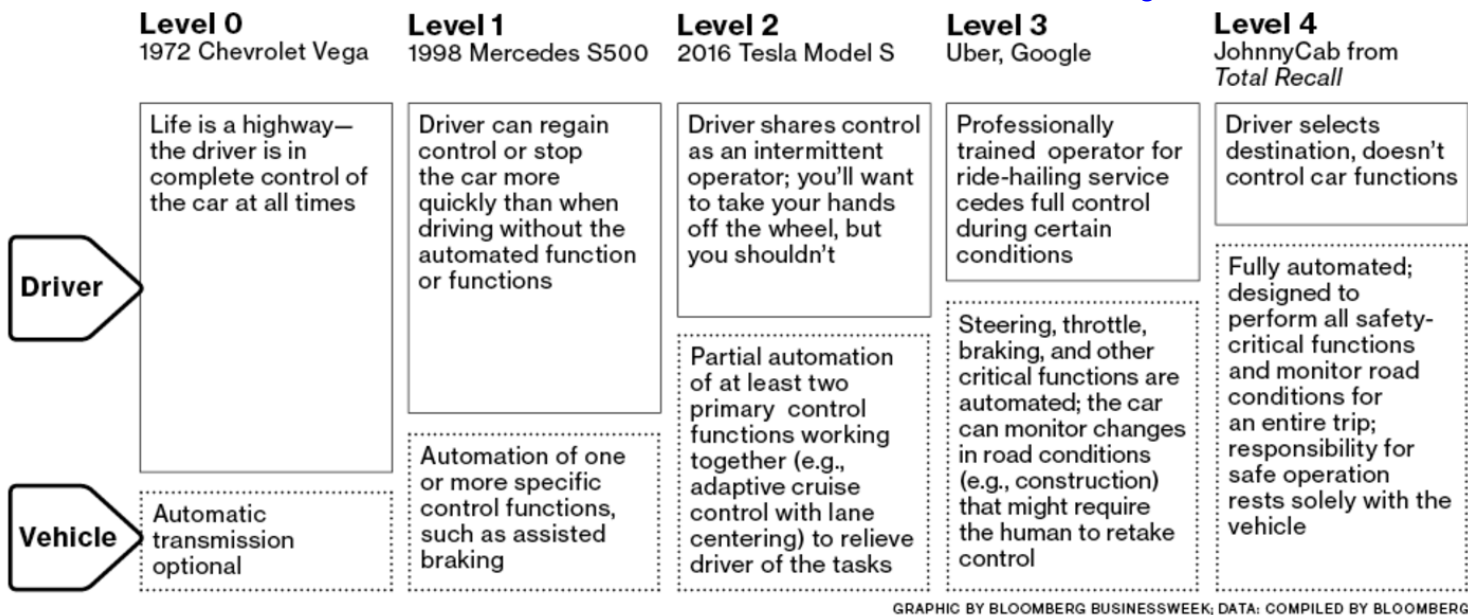
Although Kalanick and other self-driving car advocates say the vehicles will ultimately save lives, they face harsh scrutiny for now. In July a driver using Tesla's Autopilot service died after colliding with a tractor-trailer, apparently because both the driver and the car's computers didn't see it. (The crash is currently being [investigated](#) by the National Highway Traffic Safety Administration.) Google has seen a handful of accidents, but they've been less severe, in part because it limits its prototype cars to 25 miles per hour. Uber's cars haven't had any fender benders since they began road-testing in Pittsburgh in May, but at some point something will go wrong, according to Raffi Krikorian, the company's engineering director. "We're interacting with reality every day," he says. "It's coming."

For now, Uber's test cars travel with safety drivers, as common sense and the law dictate. These professionally trained engineers sit with their fingertips on the wheel, ready to take control if the car encounters an unexpected obstacle. A co-pilot, in the front passenger seat, takes notes on a laptop, and everything that happens is recorded by cameras inside and outside the car so that any glitches can be ironed out. Each car is also equipped with a tablet computer in the back seat, designed to tell riders that they're in an autonomous car and to explain what's happening. "The goal is to wean us off of having drivers in the car, so we don't want the public talking to our safety drivers," Krikorian says.

On a recent weekday test drive, the safety drivers were still an essential part of the experience, as Uber's autonomous car briefly turned un-autonomous, while crossing the Allegheny River. A chime sounded, a signal to the driver to take the wheel. A second ding a few seconds later indicated that the car was back under computer control. "Bridges are really hard," Krikorian says. "And there are like 500 bridges in Pittsburgh."

Honk If You Love Robots

The National Highway Traffic Safety Administration has defined five levels of autonomy based on how many car functions are computer-controlled



Bridges are hard in part because of the way that Uber’s system works. Over the past year and a half, the company has been creating extremely detailed maps that include not just roads and lane markings, but also buildings, potholes, parked cars, fire hydrants, traffic lights, trees, and anything else on Pittsburgh’s streets. As the car moves, it collects data, and then using a large, liquid-cooled computer in the trunk, it compares what it sees with the preexisting maps to identify (and avoid) pedestrians, cyclists, stray dogs, and anything else. Bridges, unlike normal streets, offer few environmental cues—there are no buildings, for instance—making it hard for the car to figure out exactly where it is. Uber cars have Global Positioning System sensors, but those are only accurate within about 10 feet; Uber’s systems strive for accuracy down to the inch.

When the Otto acquisition closes, likely this month, Otto co-founder Levandowski will assume leadership of Uber’s driverless car operation, while continuing to oversee his company’s robotic trucking business. The plan is to open two additional Uber R&D centers, one in the Otto office, a cavernous garage in San Francisco’s Soma neighborhood, a second in Palo Alto. “I feel like we’re brothers from another mother,” Kalanick says of Levandowski.

The two men first met at the TED conference in 2012, when Levandowski was showing off an early version of Google’s self-driving car. Kalanick offered to buy 20 of the prototypes on the spot—“It seemed like the obvious next step,” he says with a laugh—before Levandowski broke the bad news to him. The cars were running on a loop in a closed course with no pedestrians; they wouldn’t be safe outside the TED parking lot. “It was like a roller coaster with no track,” Levandowski explains. “If you were to step in front of the vehicle, it would have just run you over.”

Kalanick began courting Levandowski this spring, broaching the possibility of an acquisition during a series of 10-mile night walks from the Soma neighborhood where Uber is also headquartered to the Golden Gate Bridge. The two men would leave their offices separately—to avoid being seen by employees, the press, or competitors. They’d grab takeout food, then rendezvous near the city’s Ferry Building. Levandowski says he saw a union as a way to bring the company’s trucks to market faster.

For his part, Kalanick sees it as a way to further corner the market for autonomous driving engineers. “If Uber wants to catch up to Google and be the leader in autonomy, we have to have the best minds,” he says, and then clarifies: “We have to have all the great minds.”

—With Eric Newcomer

(Corrects Uber’s normal per-mile rate in Pittsburgh in the twelfth paragraph.)

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